

Dynamic Enhanced Recovery Technologies -- Class I

Columbia University

Multiple sandstones

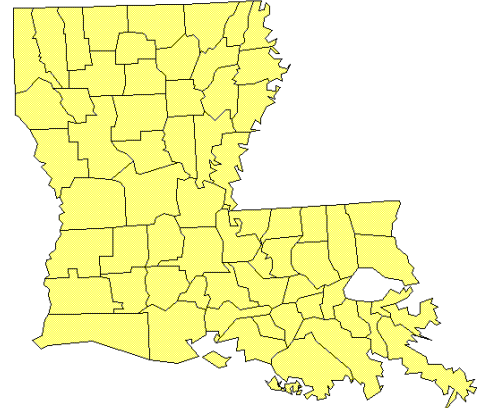
Eugene Island Block 330

@ 9,000 to 12,000 ft

Offshore Federal Waters, LA

Pleistocene Age

Gulf of Mexico



DE-FC22-93BC14961

Contract Period:

7/15/1993 to 4/30/1996

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Objective: This project will test the concept that the growth faults in a Gulf of Mexico field are conduits through which the producing reservoirs are charged and that enhanced production can be developed by producing from the fault zone. The field demonstration will be accomplished by drilling and production testing of growth fault systems associated with the Eugene Island Block 330 operated by Pennzoil in Federal waters off Louisiana.

Technologies Used: Core and fluid analysis, biostratigraphic analysis, 4-D seismic (time as the 4th dimension), borehole image and other advanced logging techniques, well testing, reservoir modeling and numerical simulation, infill drilling.

Background: The Eugene Island Block 330 field covers portions of 7 blocks near the southern edge of the Louisiana Outer Continental Shelf in water depths of 210 to 266 ft. The field consists of two rollover anticlines, bounded to the north and east by a large arcuate, down to the basin growth fault system. More than 25 Pleistocene sandstones are productive at depths of 4,300 to 12,000 ft. Faulting and permeability barriers separate these sands into more than 100 oil and gas reservoirs. Previous work, which incorporated pressure, temperature, fluid flow, heat flow, and seismic, production, and well log data, indicated active fluid flow along fault zones. The EI 330 Field is ideally suited for this study because it represents a discrete subbasin in which fluid flow has unquestionably occurred very recently in geological terms, thus providing a strong temperature and pressure signal. Hydrocarbon production there is from thermally immature sediments as young as 400,000 years BP, but the oils are from a source that is at least Cretaceous in age. Thus, recent mitigation and trapping must have occurred in these reservoirs.

Incremental Production: One million barrels of incremental oil produced.

Expected Benefits and Applications: This work could reshape the oil producer's view of where productive reservoirs might lie. If the new strategies are successful, producers in the future may avoid drilling large numbers of expensive, deep dry holes. Rather than trying to drill vertically through thousands of feet of rock-hard salt to deep hydrocarbon sources, they may be able to take advantage of the growth fault fracture system to tap deep-seated hydrocarbons as they migrate upward. These new insights could increase production from existing Gulf Coast oil fields and lead to significant upward revisions of supply estimates in the U.S. Gulf of Mexico Basin. Benefits may also extend to other similar sedimentary basins, such as those in Nigeria, the North sea, Indonesia, and the Caspian Sea. This project explores (1) the concept that Pleistocene reservoirs in the Offshore Louisiana Gulf Coast may be undergoing active 'recharge' by hydrocarbons migrating along growth faults and (2) the possibility that producing wells might be established by completion in the growth fault migration pathways.

Accomplishments: Pathfinder well was drilled into a major growth fault bounding Eugene Island 330 reservoirs. Over 350 ft of core was retrieved from the fault zone. Fluid samples were also obtained. Production could not be established in the fault zone because fracture permeability closed with production. Success in coring that introduced new technology and success in predicting the location of oil flow has promoted other fault zone tests by industry. Real-time visualization database is online and accessible by project partners. Research results have been presented to industry partners through semiannual meetings and publications, and hands-on exhibits have been presented at national technical society meetings. An oil company team member used the technology gained in this project to drill a 1,500 bbl/day well. AKCESS.BASIN basin modeling program has been released commercially. 4-D Seismic Analysis Software (with time as the fourth dimension) was developed as a product of this project. 4-D technology had spread to 60 field by 1999.

Publications: (1) Anderson, R., P. Flemings, S. Losh, and R. Woodhams, 1994b, "Gulf of Mexico growth fault drilled, seen as oil, gas migration pathway": Oil & Gas Journal, Vol. 92, (June 6) p. 97-103. (2) Anderson, R., P. Fleming, S. Losh, J. Whelan, L. Billeaud, A. Austin and R. Woodhams. 1994, "The Pathfinder Drilling program into a major growth fault in Eugene Island 330, Gulf of Mexico: Implications for behavior of hydrocarbon migration pathways": CD-ROM, Columbia, Lamont-Doherty Earth Observatory. (3) Losh, S. and J. Wood, 1994, "Brine chemistry, South Eugene Island Blocks 316 and 330": in R. Anderson, ed. Results of the Pathfinder Drilling Program into a major growth fault: GBRN/DOE Dynamic Enhanced Recovery Project in south Eugene Island 330 Field, Gulf of Mexico, CD-ROM, Lamont-Doherty Earth Observatory. (4) Losh, S., 1998, "Oil Migration in a Major Growth Fault: Structural Analysis of the Pathfinder Core, South Eugene Island Block 330, Offshore Louisiana": AAPG Bulletin, Vol. 82, No. 9, p. 1694-1710. (5) Losh, S., L. Eglinton, M. Schoell and James Wood, 1999, "Vertical and Lateral Fluid Flow Related to a Large Growth Fault, South Eugene Island Block 330 Field, Offshore Louisiana": AAPG Bulletin, Vol, 83, No. 2, p. 244-276.

Recent/Upcoming Technology Transfer Events: None

Project Status: Project is completed.